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Appendix

**Summary of the
Biological Assessment
for
Threatened and Endangered Plant Species

Santa Cruz Island Restoration Project

Channel Islands National Park**

Prepared By: Dirk Rodriguez
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Channel Islands National Park

I. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

[See Final EIS Chapter Two pgs 13-20]

II. EXISTING ENVIRONMENT

[See Final EIS Chapter Three]

III. THREATENED, ENDANGERED PLANT SPECIES

[See Final EIS Chapter Three “Threatened and Endangered Plants” pgs 48-53]

IV. T&E EFFECTS BY ALTERNATIVE.

Alternative One: No Action

In the Thirteen Plant Taxa from the Northern Channel Islands Recovery Plan (USFWS 1999), feral pigs were identified as a potential threat to each of the nine listed plant species found on Santa Cruz Island - Hoffman’s rock cress (*Arabis hoffmanii*), island barberry (*Berberis pinnata* ssp. *insularis*), Santa Cruz Island dudleya (*Dudleya nesiotica*), island bedstraw (*Galium buxifolium*), island rush-rose (*Helianthemum greenei*), Santa Cruz Island bushmallow (*Malacothamnus fasciculatus* ssp. *nesioticus*), island malacothrix (*Malacothrix indecora*), Santa Cruz Island malacothrix (*Malacothrix squalida*), and Santa Cruz Island fringe pod (*Thysanocarpus conchuliferus*). Under this alternative the threats to each of the listed species would remain. Fluctuations in the severity of impacts would occur seasonally and yearly as feral pig numbers changed. However, the potential for recovery of rare plant species would still be negligible even during those years when feral pig numbers are low. This is because the number of feral pigs on Santa Cruz Island is tied to food availability. Pig numbers are lower during drought years when little food is available but these periods of low rainfall would also likely inhibit overall plant growth and reproductive success in those plants that are rare. Therefore, the chance for extirpation of occurrences and species extinction would continue to be higher in all years with pigs, than in the absence of feral pigs.

Direct Effects:

Direct impacts to listed plant species would include herbivory of T & E plant species by feral pigs and the trampling, crushing, and uprooting of listed plant species should feral pigs walk, bed down, or root within listed plant occurrences. Depending on the number of individual pigs within an area, one to many T & E plants may be grazed, trampled, or uprooted. Those occurrences that are found in areas of high pig use would likely incur the most damage. Because the rarity of these listed plant species is defined by their limited numbers, even relatively small impacts can have a large detrimental effect. Individual plants lost through predation, trampling, or uprooting cannot contribute off-spring to the succeeding generation. This results in a loss to the next generation in both absolute numbers and potential genetic diversity. A decrease in genetic diversity can lead to an overall decrease in evolutionary fitness for a

species. Decreased population numbers leads to increased potential for extinction from continued predation, or from large random disturbance events such as a fire, earthquake, or landsliding.

Indirect Effects:

Indirect effects include alterations in listed plant micro-habitats, soil erosion, and facilitation of the spreading of invasive, non-native plants into the habitats of listed plant species. Disturbances caused by feral pigs in and around listed plant occurrences can lead to increased erosion within those occurrences. This increased erosion can expose the roots of listed plant species inhibiting water and nutrient uptake or in severe cases completely up-root individual plants. Disturbances caused by feral pig foraging and rooting can also facilitate the spread of invasive, non-native plant species within listed plant occurrences. Invasive, non-native plant species can out-compete native plant species including listed plants for available nutrients and water. This can lead to the local extirpation of listed plant occurrences. Infestations of non-native invasive plant species can also alter the micro-habitats of an area. This could render occupied habitat unsuitable for those species occupying the site or it could prevent the expansion of listed plants into what otherwise would be favorable sites. Limiting the number of suitable habitats for rare plant species further exposes the present occurrences to extinction through random stochastic events.

Feral pigs, like all animals, excrete excess nutrients and waste in the form of urine and feces. Chemicals, primarily nitrogen, in urine can chemically burn individual plants and alter the micro-habitats around the point of urination (Williams and Haynes 1994). Pig feces can cover individual plants blocking their access to sunlight, reducing the plants vigor and health (Williams and Haynes 1995). Adjacent plants may benefit from the extra nutrients available in urine and feces similar to the effects seen with the application of normal fertilizer. Increased nutrient availability may still be evident three years after deposition of dung (Williams and Haynes 1995). Typically though, it is the weedy non-native plant species that benefit the most from increased nutrient availability.

Cumulative Effects:

Cumulative effects are those factors which in the past, present, or future have affected T & E plant species. All species - but especially those with small population sizes - face the threat of extinction. Threats to a species survival include competition from other species, disease, predation, habitat loss, long-term environmental trends, and catastrophic events. Species with small populations also face threats to their gene pool from inbreeding, loss of heterozygosity, and, for those species arising from colonization and subsequent adaptive radiation, possible Founder effects. There is no clear indication however whether a decrease in genetic diversity leads to a decrease in species fitness (Shafer 1990).

Cumulative effects that may impact listed plant occurrences are similar to those listed for plant communities but the consequences may be more severe. Because listed plant species are rare and limited, either in absolute numbers or number of occurrences, impacts to a portion of a population can have severe consequences. Common plant species are often extirpated in localized areas, either from natural disturbance events or human caused disturbances. These areas are usually eventually re-colonized however, from seed stored in the soil or propagules from adjacent areas. Rare plants species on the Santa Cruz Island don't have those options because either their seed bank has been severely

disrupted from years of over-grazing or distances between known occurrences are usually too great to allow for re-colonization.

Alternative Two (Island-wide eradication)

The short-term impacts associated with this alternative although similar in nature to those described for the plant communities could be more severe for listed plant species. This is due to the inherent rarity of these species. Trampling of even only a few individuals could have a substantial impact on a single occurrence. Some of the listed species which are annuals like *Thysanocarpus conchuliferus* and *M. indecora*, would be protected for much of the year when they exist only as seeds in the soil. They would be prone to trampling effects though when they are actively growing. Some occurrences of rare species like those *Galium buxifolium*, *M. squalida*, and *Arabis hoffmannii* occurrences would be protected due to their growing on steep, coastal bluffs. Areas that are unlikely to be traversed by either feral pig or pig hunter. *Dudleya nesiotica* is also in a fairly remote area but it is more accessible. However this population would be able to recover from incidental trampling of individuals because of the large number of plants (30,000 – 60,000) within the population. Feral pigs are known to root up the plants however (USFWS 2000). *Berberis pinnata* ssp. *insularis* and *Malacothamnus fasciculatus* var. *nesioticus* would likely be protected from trampling because of their stature as large perennial shrubs. Young seedling and saplings of these species would continue to be at risk however. *Helianthemum greenei* while neither an annual nor located in inaccessible areas is also somewhat insulated from impacts associated with trampling. This is because of its known life history which appears to be that of a fire follower. There are four relatively large occurrences of this plant on SCI, ranging from 500 to 1,000 plants. This large number is believed to be related to having been burned in 1994. It is likely then that the 10 smaller occurrences each has a substantial seed bank which would be expressed once they are burned. As seeds stored in the soil they would be unaffected by trampling. Trampling does pose more of a substantial threat to two occurrences *Arabis hoffmannii*. *A. hoffmannii* is a short-lived perennial plant with a slender stature. Individuals could be trampled relatively easily. The severity of such an impact may depend on which stage of its life cycle the plant is disturbed. If an individual is disturbed in a non-flowering season, it is possible the plant may recover and reappear the following year. If the plant is in flower however this may not be the case as the plant normally dies after having flowered and set seed.

In the case of a fire, the adverse impacts to listed species – except for *H. greenei* - are likely to be more severe. A large fire could cause the extirpation of one or more rare plant occurrences. Some of the listed plants occurrences would again be protected because the habitat where they occur is not likely to occur (e.g. steep, coastal bluffs). Because the likelihood of an accidental fire becoming large would only be in the fall, annual plants such as *T. conchuliferus* and *M. indecora* would be relatively insulated as seeds in the soil. Another concern with fire is the possibility that it will stimulate germination of seed stored in the soil. If the resulting seedlings are trampled, uprooted, or prevented from reaching maturation, then they will not replenish that species seed bank. The end result may be the extirpation of that occurrence.

In the long-term, T & E plant species should experience increased survivorship and seedling establishment and recruitment. T & E plant species are likely to benefit from decreased disturbance levels, increased litter retention, and re-development of the soil crusts. As T & E populations recover,

they should be able to better withstand any natural disturbance events that may occur. Larger population numbers provide insurance against the loss of a few individuals and the formation of genetic bottlenecks. Replenishment of the seed bank - for those species which rely on natural disturbance events - means adequate seedling establishment and recruitment will occur when the next disturbance event hits.

An example of recovery by a rare plant species was demonstrated on Santa Barbara Island with the Santa Barbara live-forever (*Dudleya traskiae*), a succulent perennial that is endemic to the island. Santa Barbara live-forever was considered extinct due to the presence of feral rabbits on the island, which had been brought to the island by military personnel during World War II. By 1955, the feral rabbit population on the island peaked at about 2,600. Around that time, the National Park Service began shooting the rabbits. By 1958, the rabbits were largely extirpated from the island and by 1974, Santa Barbara Island live-forever began to reappear in areas that had been largely denuded by the rabbits (Sauer 1988). Today there are approximately 500 individuals of Santa Barbara Island live-forever. For other species such as Santa Catalina mimulus (*Mimulus traskiae*), it may be too late. This species was only known from Santa Catalina Island and has not been seen for over 60 years.

Alternative Three (Eradicate on NPS property and control around sensitive resources on TNC land)

Under this alternative, T & E plant occurrences would be protected on both NPS and TNC property on Santa Cruz Island. However, there would be difference in how they are protected. Those occurrences on NPS property would be able to expand beyond their current locations, as feral pigs would not be present on that portion of the island. Expansion of rare species into existing unoccupied habitat provides some measure of protection against extinction from random stochastic events. Expansion of listed species into unoccupied suitable habitat is an integral part of the draft recovery plan for these species (USFWS 2000). The occurrences on TNC property however would be limited to their present locations, as feral pigs would have access to any current unoccupied habitat for those species. Without the possibility of expanding their number of occurrences these species would be at greater risk of extinction from random stochastic events.

Because the T & E plant occurrences on TNC property would be fenced, they would theoretically be free from direct predation by feral pigs. However, feral pigs are notorious for undermining fencing on Santa Cruz Island (Aschehoug, personal communication) and in order for the fencing to be effective, it would have to be constantly maintained. It is unlikely that the commitment of resources necessary for this type of maintenance is possible over the long-term and it is probable that some of the fencing would be breached in the future, allowing for direct predation on some of the “protected” T & E occurrences. For those occurrences, the T & E plants would be subject to the direct impacts associated with the presence of feral pigs, as listed under Alternative One.

While initially free from direct predation, the T & E species on TNC property would still be subject to all of the indirect impacts associated with the presence of feral pigs, as listed under Alternative One.

There are seven known occurrences of listed plant species on NPS property – 5 occurrences of island rush-rose (*H. greenei*), 1 occurrence of island malacothrix (*M. squalida*), and 1 occurrence of island

bedstraw (*G. buxifolium*). There are 28 known occurrences of listed plant species on TNC property – 1 occurrence of (*D. nesiotica*), 8 occurrences of island bedstraw (*G. buxifolium*), 3 occurrences of island barberry (*B. pinnata* ssp. *insularis*), 1 occurrence of Santa Cruz Island malacothrix (*M. indecora*), 3 occurrences of Santa Cruz Island bushmallow (*M. fasciculatus* var. *nesioticus*), 1 occurrence of Santa Cruz Island fringe pod (*Thysanocarpus conchuliferus*), 3 occurrences of Hoffman's rockcress (*Arabis hoffmanii*), and 8 occurrences of island rush-rose (*Helianthemum greenei*) (USFWS 2000).

Alternative Four (sequential eradication through fencing)

Direct Impacts:

Direct impacts to listed plant species could occur if fencing were placed within listed plant occurrences. Individual plants could be crushed or uprooted when fence posts are placed in the ground. NPS employees could also inadvertently crush plants by walking or driving over them. This could occur when initially constructing the fence or during maintenance of the fence. With proper planning, known rare plant occurrences could be avoided and botanical surveys conducted to locate unknown rare plant occurrences so that they could also be avoided. However, botanical surveys can sometimes overlook T & E plant occurrences. The accuracy of the survey depends on the timing (when the survey is conducted) and the familiarity of the surveyor with the plants in question. The possibility exists that even with botanical surveys being conducted that T & E plant occurrences could be missed and subsequently impacted by the installation of the zoning fences. Until a zone is hunted free of pigs, any T & E plant occurrences in the zone would be subject to the direct impacts associated with the presence of feral pigs as described under Alternative One. For those T & E occurrences in the last zone to be hunted free of pigs, this would mean an additional six years of impacts associated with the presence of feral pigs.

Indirect Impacts:

Indirect impacts to listed plants could occur if invasive non-native seeds are transported into listed plant occurrences either on the fencing material itself or on the boot and clothing of the NPS employees constructing the fence or on the vehicles used to move the fencing material. As discussed previously, invasive weed species are able to out-compete native plant species including T & E plants for available water, nutrients, and sunlight. Measures such as washing vehicles, removing seeds from boots and clothing, and educating those involved in constructing the fences about the dangers of invasive weed species, can be enacted to minimize the risk of spreading these weed species. Until a zone is hunted free of pigs, any T & E plant occurrences in the zone would be subject to the indirect impacts associated with the presence of feral pigs as described under Alternative One. For those T & E occurrences in the last zone to be hunted free of pigs, this would mean an additional six years of impacts associated with the presence of feral pigs.

Cumulative Impacts:

The cumulative impacts associated with this alternative would be similar to those discussed under

Alternative Two.

V. DETERMINATION OF EFFECTS

Alternatives 1 or 3:

It is my determination that selection of alternative 1 or 3 may affect and is likely to adversely affect *Galium buxifolium*, *Malacothrix indecora*, *Dudleya nesiotica*, *Malacothrix squalida*, *Berberis pinnata* ssp. *insularis*, *Malacothamnus fasciculatus* var. *nestioticus*, *Thysanocarpus conchuliferus*, *Helianthemum greenei* and *Arabis hoffmannii* and their critical habitat. Endangered Species Act Section 7 Formal Consultation with U.S. Fish and Wildlife Service will be required for this project.

Alternatives 2 or 4:

It is my determination that selection of alternative 2 or 4 under the Santa Cruz Island Restoration project (a) will not affect (**with the recommended mitigation**): *Malacothrix indecora*, *Malacothrix squalida*, *Berberis pinnata* ssp. *insularis*, *Malacothamnus fasciculatus* var. *nestioticus*, *Thysanocarpus conchuliferus* and *Arabis hoffmannii*; and (b) may impact individuals of *Helianthemum greenei* and *Dudleya nesiotica* but is not likely to adversely affect them.

VI. MITIGATION RECOMMENDATIONS

- Re-visit sites of extant and historical occurrences for *Arabis hoffmannii*, *Berberis pinnata* ssp. *insularis*, *Galium buxifolium*, *Malacothamnus fasciculatus* var. *nesioticus*, *Malacothrix indecora*, *Malacothrix squalida*, *Thysanocarpus conchuliferus*, *Helianthemum greenei* and *Dudleya nesiotica*.
- Fencing of any of the re-visited sites where it is determined that pig rooting or trampling by hunters has or may impact a site. This recommendation is impractical for *H. greenei* or *Dudleya nesiotica* due to the relatively large sizes of their occurrences. The number of individuals within their occurrences though should be sufficient to withstand impacts associated with the eradication of feral pigs. *H. greenei* is also somewhat protected due to its use of a stored seed bank as an integral part of its life history. Impacts to *D. greenei* could be significantly reduced under alternatives 2 and 4 by initiating the hunt at the west end of the island.
- Placement of sensitive resource signs in areas where hunt activities could occur in *H. greenei* and *Dudleya nesiotica* occupied habitat. Hunters should be instructed to avoid these areas unless active pig use is occurring in them.
- Annual inspection of any T and E fenced occurrences. If the occurrences are not effective in protecting the occurrences then consultation with USFWS will occur.
- No smoking allowed while hunting
- Maps of sensitive areas plant areas made available to fire suppression supervisors

VII. OTHER MANAGEMENT RECOMMENDATIONS

Fennel Treatment:

- 30' to 50' buffer zone between fennel dominated areas to be treated and outside, adjacent native plant communities. Fire may run through these areas and into adjacent native plant habitat but these areas should recover from a single fire event. The most important aspect of the buffers would be to minimize accidental overspray of Garlon into adjacent intact native plant communities. This buffer zone could then be herbicided by hand if necessary.
- Relatively large, intact native plant communities within the treatment area should be identified and protected from prescribed burning and aerial spraying of Garlon. It is important that these native plant refugia survive relatively intact as they can serve as native plant seed sources for the treated areas.
- All major drainages should be identified and to the extent practical protected from fire and herbiciding. These areas have largely intact native plant communities and serve to filter rainwater and decrease peak water flows.
- Measures should be taken to prevent the spread of yellow star thistle into the treated area. All vehicles traveling from yellow star thistle infested areas should be cleaned before entering the project area. Areas where it is known to occur on the isthmus - along the roadside near Prisoner's Harbor – should be treated as soon as possible. Monitoring should be conducted within the treated area for two years following the large-scale treatment and any detected infestations of yellow star thistle should be rapidly treated.

LITERATURE CITED

References:

[See Final EIS “References” pg. 181

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